A GUIDE TO FILING APPLICATIONS FOR INSTREAM FLOW WATER RIGHTS IN ARIZONA

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I. INTRODUCTION

Due to the increasing demands placed on Arizona's limited water resources along with legal mandates to protect and preserve natural resources, the preservation of instream flows for the maintenance of fish, wildlife, and recreational uses has become critical. ***Instream flow***, as defined in this guide, is the maintenance flow necessary to preserve instream values such as aquatic and ***riparian*** habitats, fish and wildlife and riparian-based recreation related to a particular stream or stream segment(s).

Rates of impoundment, diversion and groundwater use threaten to adversely reduce streamflows or even de-water streams to the present and future detriment of aquatic and terrestrial resources. As a result of the high demand for water by various competing interests, the value placed upon water has increased markedly. Although the value of water withdrawn from a stream for agricultural, industrial, mining or municipal use has been commonly recognized, instream uses have only recently begun to be recognized for their importance.

Instream flows are inherently linked to riparian areas and their associated resources. In addition to adequate available flows, fish, wildlife and many recreational activities depend on or are enhanced by the maintenance of these areas. On February 14, 1991, Governor Rose Mofford issued Executive Order NO. 91-6 dealing with the importance of riparian areas in Arizona. The Executive Order includes the following statement of policy: **The State of Arizona shall encourage the preservation, maintenance and restoration of instream flows throughout the State.**

This guide provides assistance to applicants applying for a Permits to Appropriate Public Water for instream flow purposes (***permit***). Applicants will be required to collect and analyze data in a manner sufficient to support the requested ***appropriation***. The methods used to evaluate the data are dependent upon several factors that vary for each application. Despite this variability, ADWR provides, in this guide, the minimum criteria for substantiating instream flow requests. Additionally, the report describes some of the many methodologies available to assess instream flows in Arizona.

Applicants are encouraged to meet with the Arizona Department of Water Resources (ADWR) personnel at the earliest possible stages of an instream flow evaluation process in order to formulate a program of study that will best assess an individual instream flow request by determining:

- The amount of water necessary for instream fish, wildlife or recreational uses and,

- The availability of the requested flows during claimed periods of ***beneficial use***.

II. INSTREAM FLOW APPROPRIATION PROCESS AND REQUIREMENTS

The appropriation of public water for the purpose of maintaining instream flows requires the assessment and the measurement of the availability of the streamflow requested for the stated purpose. Each instream flow appropriation may vary considerably in stream characteristics, morphology, the amount of streamflow required for the beneficial use, the availability of water supply, and legal aspects. Therefore, the methodologies used to assess streamflow availability and instream flow needs may also differ.

Despite the variability in instream flow appropriations, ADWR has identified certain minimum requirements for assessing the need and available supply for the proposed appropriation. The requirements are divided into the following 7 steps and are presented in accordance with ADWR's basic surface water appropriation process. This process includes *application*, *permit* and *certification* phases.

STEP 1. Pre-application conference with ADWR

The applicant is encouraged to contact the Surface Water Rights Section Manager to set an appointment to meet with ADWR technical and administrative staff to discuss the proposed instream flow appropriation. The purpose of the meeting is to make the applicant aware of ADWR requirements for appropriating public water for this type of beneficial use, to answer any questions, and to avoid potential problems during the application process. The applicant may review applications on file to determine how other applicants in similar circumstances designed their data collection and analysis programs.

The meeting should preferably occur prior to any data collection, but should occur before the submittal of a minimum of one year of streamflow measurements required to obtain a permit. There are several methodologies available for assessing instream flow requirements and the availability of the water supply. Meeting with ADWR's staff early in the appropriation process will provide the applicant with needed direction.

STEP 2. Begin or continue data collection

The collection of streamflow measurements should be one of the first steps of the assessment process. This data provides the applicant and ADWR with information regarding the availability of the water supply during a given time period. In addition, the measure of any permitted beneficial use is stated in terms of the rate of flow.

STEP 3. File the appropriations application

The Application for Permit to Appropriate Public Water must be filed with the ADWR's Surface Water Management Division, located at 500 North 3rd Street, Phoenix. The application must be submitted on a form provided by ADWR. A blank copy of the application form is included in the back folder of this document for use by the applicant.

The submitted application is subject to review for acceptance. Therefore, all questions on the form must be answered as completely as possible. If a submitted application is found to be in error or deficient, the applicant will be required to correct the application, or it may be subject to rejection. The filing date of the application is the ***priority date*** of the appropriation. If an application is found to be deficient and the applicant fails to resubmit the correct application within 60 days of notice of the error or omission, ADWR may void the original priority date. Additional time may be granted if for good cause and if requested in writing.

Monthly or seasonal streamflow rates originally claimed on an application to appropriate may be amended based on the results of the study described in Step 4. This is not considered a deficiency in the original application and can be accomplished without the loss of the priority date. **The total volume (in acre-feet per year) must also be stated in the application and can only be amended to a lower volume from the amount listed in the public notice**(See Step 5).

STEP 4. Conduct data analysis and submit report

Prior to this step, the applicant should have met with ADWR's staff to formulate a proposed method of study to determine instream flow requirements for the proposed beneficial use and the availability of the water supply to meet those requirements.

A minimum of one year of streamflow measurement data is required to be submitted by the applicant before ADWR will issue a Permit to Appropriate Public Water. In addition, the applicant is required to submit a report of the results and conclusions of data analysis based on the methodology developed in the prior meeting with ADWR's staff.

The report may be submitted at the time of filing of the appropriation application, but can be submitted after the filing date. If the required report is not submitted, the application may be rejected. The report must, at a minimum, include:

1) A description of both the streamflow data-collection method used in the study and method of assessment of streamflow requirements for the proposed appropriation.

2) A description of the beneficial use intended for the instream appropriation. This must describe the relationship between the required streamflow and the benefits received by fish, wildlife and/or recreation activities.

3) The analysis including the raw data of actual streamflow measurements collected for a minimum of one year, with **at least one on-site measurement taken each month of claimed beneficial use or at least three random on-site measurements taken during each primary flow season** (e.g., during spring runoff, prior to onset of monsoonal rains) of claimed beneficial use. Separate flow rates must be requested for each month or each flow season.

4) A description of the streamflow, stream morphology and the resources associated with the instream flow. This includes fish and wildlife species, riparian vegetation and stream channel and flow characteristics.

5) An assessment of the streamflow historically available at the location of the proposed instream appropriation.

STEP 5. Public notice of application and opportunity for protest

Once an application is judged to be complete and correct an official ***public notice*** of the proposed appropriation will be drafted by ADWR. This public notice will list the total annual volume (in acre-feet) and the location of the proposed appropriation and is to be posted by the applicant for 30 days in the locality to be affected by the proposed appropriation. An ***affidavit of posting notice*** must be submitted by the applicant after the period of public notice. A sample public notice and a blank Affidavit of Posting Notice are attached in the back folder. The proposed appropriation is subject to protest during a 60-day period from the date the public notice is issued. The proposed appropriation may be protested on the grounds that the appropriation: 1) impacts a prior-vested water right, 2) is not in the best interest of the public, or 3) presents a hazard to public safety.

If a protest is submitted against the proposed appropriation, the applicant should attempt resolution with the protestant. If a protest is not resolved within a reasonable amount of time, the Department will review the application and the submitted protest. The Department may then conduct a public hearing on the matter, dismiss the protest, or reject the application.

The process of resolution of any submitted protests may consume substantial amounts of time and delay issuance of a permit. It is therefore advantageous to the applicant to have determined valid flow-rate requests to support their claim. Strict control and attention to detail in conducting streamflow measurements may prevent unnecessary delays in both the review process and the administrative procedure (see Appendix A).

STEP 6. Issuance of a Permit to Appropriate Public Water

When ADWR's staff concludes from the analysis of the submitted report and data that the minimum requirements have been satisfied and a permit fee is received, a permit will be issued to the applicant. The entitlement is usually allocated as a flow rate and apportioned on a monthly basis throughout the year. The permit will list required monthly flows, the total annual flow volume and may contain conditions or other stipulations concerning the perfecting of the appropriation. Based on subsequent data submitted by the applicant to obtain a ***Certificate of Water Right***, monthly flows may be adjusted up or down, however, the total annual flow volume cannot exceed the amount listed on the permit.

STEP 7. Issuance of a Certificate of Water Right (CWR)

The permit holder is required to demonstrate that the instream flow water right is being used in a manner consistent with terms of the issued permit. **A minimum of four years of streamflow measurement data is required before ADWR may consider the proposed appropriation perfected**. Prior to the permit becoming a candidate for certification, the applicant must submit the following to the Department:

1) Proof of Appropriation (with total annual volume in acre-feet)

2) Affidavit of Appropriator

3) Minimum of 4 years of streamflow data

4) Analysis of streamflow data

If a total of 4 years of data is available at the time of permit issuance, it is possible to move directly to the certificate stage. When an analysis of the submitted ***Proof of Appropriation*** and supporting evidence concludes that the appropriation has been perfected and a processing fee received, ADWR will then issue the certificate. **It is important to note that the total annual volume certificated cannot exceed the amount permitted or the amount listed on the Proof of Appropriation.** A blank Proof of Appropriation and ***Affidavit of Appropriator*** are attached in the back folder.

While an instream flow water right holder is not required to submit streamflow information to ADWR following certification, continued streamflow measurement is strongly advised. Lack of adequate data may result in the inability of a right holder to prove infringement on an instream flow right from other surface water diversionary rights.

III. INSTREAM FLOW RESOURCE ASSESSMENT METHODS

An abundance of methodologies quantifying instream flow requirements of fish, and to a much lesser degree recreation and wildlife, have been proposed over the past 20 years. Some methodologies are species, habitat or activity specific; others require U.S. Geological Survey (USGS) flow records; some involve complex hydraulic simulation using comprehensive field data in conjunction with computer programs; while other methodologies attempt to predict species usage through evaluation of key habitat parameters.

Methodologies available to quantify instream flows for fish, wildlife and recreation vary in sophistication and precision. These range from simple visual judgements pertaining to the sufficiency of historical flows to elaborate computer models that can estimate flow requirements of specific fish, wildlife and recreational needs. The applicant should keep in mind that Arizona's Surface Water Code does not recognize riparian vegetation as a beneficial use for which surface water can be appropriated. However, ADWR recognizes the importance of a viable riparian ecosystem to fish, wildlife, and recreation. The presence of this direct relationship and the requirement of certain hydrologic conditions necessary for the survival of riparian vegetation are commonly evaluated in determining flow requirements of the beneficial uses.

The two basic categories of instream flow methodologies are the ***Standard Setting*** and ***Incremental Methods***. Standard setting methods identify minimum flow standards required to protect a stated beneficial use, while incremental methods quantify flow-related trade-offs between various instream flow levels and the protection of instream flow values. While this guide does specify minimum criteria necessary for substantiating an instream flow request, it does not mandate the use of any particular methodology for any specific situation. Selection of the most appropriate instream flow methodology should be based on the following considerations:

- The legal challenge the application is likely to face
- The water requirement of the claimed beneficial uses
- The characteristics of the stream and historical flow records
- Presently used and accepted methods
- Time, money and labor constraints
- Capability of method to predict probable consequences of flow modifications
- Flexibility of method (i.e., ability to refine, modify method to meet specific needs)

Standard setting methods are generally applicable to streams where applications are not likely to be protested and/or water rights are unlikely to face legal action. Incremental methodologies are usually recommended for streams in which applications may face significant protests by other water users or where water rights are likely to require resolution through legal action. The intensity of this

methodology is commensurate with the perceived legal challenge and the need for detailed study. Streams that require incremental methods are generally of critical importance to state or federal natural resource management agencies. In most instances, these surface waters support populations of either rare and endangered or economically valuable fish and/or wildlife species or are important for their recreational values. This could include high recreational use areas or areas suited for ***wild and scenic*** or riparian conservation area designations.

In Arizona, most of the streams where instream flow applications have been or may be filed in the future do not exhibit the controversial aspects mentioned above. Many streams are situated in headwater locations, in areas where springs allow for surface flow for very short distances, or where ***baseflow*** of the stream is usually very small. In these types of applications, ADWR will allow the resource assessment technique to be a *narrative description* which correlates the requested flow with the fish, wildlife, or recreation benefits expected from the appropriation (see Appendix B). This method may be used only in combination with requests for median monthly flows (excluding flood flows). To obtain an instream flow water right for streamflows greater than the median flow rate, an applicant must utilize a technique, such as an incremental methodology, that adequately quantifies the relationship between the claimed beneficial uses and streamflow.

This portion of the guide provides a summary of the various instream flow methodologies (along with selected references) most applicable to conditions in Arizona. For additional information on instream flow methodologies, please contact the Hydrology Division of ADWR. Methodologies should be evaluated on their strengths, weaknesses, adaptability and appropriateness.

A. STANDARD SETTING METHODS

Standard setting methods can be divided into "Non-field" and "Habitat Retention" methods (McKinney and Taylor, 1988). *Non-field methods* (including the Narrative Justification Method) support flow requirement decisions that are based on historical flow records rather than on field observations. Non-field methods are quick and easy to apply when data are available, but are inflexible and have limited accuracy. They are generally used to set interim instream flow standards or for reconnaissance-level projects. *Habitat Retention Methods*, on the other hand, examine relationships between ***discharge***, fish habitat, wildlife habitat and recreational use indices to derive flow recommendations. The Habitat Retention Methods identify flow levels where desirable aquatic habitat characteristics are retained. Some of the techniques may be utilized in either a single or multiple transect scenario.

Another technique is the *Interdisciplinary Approach*. Unlike most standard setting techniques, this method incorporates a variety of evaluation methods that not only assess resource needs and streamflow availability, but also address associated habitat and legal conditions. This process may also be used in conjunction with higher level single and multiple transect methods or incorporated into an incremental evaluation technique. The intensity of this evaluation is determined by beneficial use needs, the perceived level of legal challenge and current and future management objectives. Of the many standard setting methods, only the Narrative Justification, Habitat Retention and Interdisciplinary Approach are described below.

1) Narrative Justification Method

As mentioned above, many perennial ***stream reaches*** in Arizona are located in areas where little or no impact on other water users is likely. For these stream reaches ADWR will allow abbreviated studies which document the beneficial use aspects of the proposed instream flow. In many cases the relationship between a perennial stream and the benefits for fish, wildlife or recreation may have already been recognized in other ways such as designation of the area as a wilderness, a wildlife preserve, or as an area of ***unique waters***.

The narrative justification will be allowed when the requested instream flow can rely primarily on streamflow records that demonstrate the beneficial use will occur at a rate of median monthly flows. With this method the applicant must describe the beneficial uses for which the instream flow right is sought. The physical setting should be described as well as any fish and wildlife resources whose existence depends directly or indirectly on the streamflow. If unique habitat is located along the stream reach or if threatened or endangered species are dependent on the flow, this information should be documented. If recreation is the beneficial use, the description should provide information on accessibility to the site, the type of recreational activity and the number of visitors. The key aspect of this method is to demonstrate that there is a relationship between the beneficial uses and the instream flow. Efforts should also be made to describe possible negative effects from decreased flow below the requested levels.

The Narrative Justification Method represents a low cost method which, when used in conjunction with supportable hydrologic data, documents the relationship between the beneficial uses and the instream flow. Because the method is based on the judgmental expertise of the applicant, it is obviously a difficult method to defend if challenged. The primary use of this method is for applications on streams where there will be little or no controversy and where no increase in ***consumptive use*** is anticipated. However, because the method will save considerable time, effort, and money for the applicant, ADWR feels that this method is acceptable when used in the appropriate circumstances. A guide to preparing a narrative justification is presented in Appendix B. Copies of studies using the Narrative Justification Method are available for review by prospective applicants at ADWR.

2) Habitat Retention Methods

Some of these simple incremental techniques may be applied to information gathered from either a single transect or multiple transects. Decisions regarding the number of transects necessary to describe resource needs are dependent on whether resource needs for the claimed stream segment can be adequately described and met by flow requirements determined from a single location on the stream. Multiple transects may be necessary when more than one beneficial use is claimed.

In addition, the degree of controversy surrounding the instream flow application may aid in determination of the number of transects needed to determine beneficial use water requirements. These methods may also serve to validate instream flow rate requests that are greater than median flow rates observed during periods of claimed beneficial use.

Transect methods are used to determine the flow which maintains the essential habitat requirements of a particular species or activity. A single transect is selected at a site considered critical to fish, wildlife

or recreational uses. The assumption is that flows must be maintained at these critical sites for fisheries protection. Established criteria (depth, velocity and ***wetted perimeter***) are used to determine the "limiting" factor for migration, spawning, and other life stage requirements.

Typically, multiple transect methods include selection of at least three sites, each representative of a different habitat type (e.g. ***riffle***, ***run***, ***pool***). Average depth, velocity, and percent wetted perimeter are determined and minimum criteria are established for "limiting" factors. Methods allow for comparisons among cross-sections by averaging ***hydraulic property*** changes with flow or by selection of the most critical cross-section.

3) Interdisciplinary Approach

This approach advocates an interdisciplinary evaluation process, rather than the use of specific methods, to assess streamflow hydrology, beneficial use requirements and legal aspects. The flexibility inherent in this process can create an assessment that is specific to the stream channel and resource values being evaluated. This may involve no more than a qualitative description of the relationship of the claimed beneficial uses and associated values with available streamflow or it may require a quantitative description. This approach may be amenable to legal challenge depending on the techniques selected to evaluate flow dependent resources.

Initially, an interdisciplinary project team is selected to conduct preliminary field assessments and review literature to initiate plan development. Details assessed are identification of physical, biological and cultural values, project objectives, streamflow evaluation methods, time frame, budget needs and final products. Stream values associated with beneficial uses identified in the preliminary assessment are then evaluated for their dependence on flows or flow-related conditions. Of particular importance are time patterns of flow regimes and channel morphology associated with high flows and channel dynamics.

For instream flows likely to be challenged in court and for those applications requesting flow rates higher than the median, the data should be developed so that the relationship between required flows and resource needs are quantified or otherwise convincingly demonstrated.

The Interdisciplinary Approach can be utilized in a wide variety of instream flow situations. The level of effort needed to generate recommendations, based on this method, can vary considerably. Depending on circumstances, simple description and qualitative analysis of the beneficial uses dependent on instream flow maintenance may be adequate. Other circumstances may warrant the use of a standard setting, multiple transect or incremental technique to quantitatively determine necessary flow rates.

B. INCREMENTAL METHODS

The previous methods discussed involve the selection of ***critical reaches*** followed by the identification of minimum flows based on the needs of claimed beneficial uses. These methods assume that if flows are sufficient in these reaches they will be sufficient along the rest of the claimed stream segment. Incremental methods, on the other hand, through the development of valuative judgements at a

number of different flow levels, more completely document the relationships between flows and specified uses.

1) Instream Flow Incremental Methodology (IFIM)

The Instream Flow Incremental Methodology (IFIM) was developed by the Aquatic Systems Branch of the National Ecology Center (formerly the Cooperative Instream Flow Service Group) and the U.S. Fish and Wildlife Service. IFIM initially attempted to integrate the planning concepts of water supply, analytical models and empirically derived habitat versus flow functions. It has since evolved into a river network analysis that incorporates fish habitat, recreational opportunity and woody vegetation response to alternative water management schemes (Stalnaker and others, 1994).

An integral component of IFIM is PHABSIM (Physical Habitat Simulation), which includes the following components: 1) physical measurement of depth, velocity, substrate and cover; 2) computer simulation of stream hydraulics; 3) determination of species and life history ***habitat suitability curves*** and 4) calculation of ***weighted useable area*** (WUA) for each flow regime, fish species and life history stage. The hydraulic simulation predicts depths, velocities, substrates habitat and legal conditions. This process may also be used in conjunction with higher level single and multiple transect methods or incorporated into an incremental evaluation technique. The hydraulic simulation predicts depths, velocities, substrates and the amount of preferred physical habitat (collective WUA) within a stream reach for a range of various discharges. From this simulation and knowledge of micro-habitat preferences of resident fish, the amount of suitable habitat for a given species and life stage can be determined. Instream flows can be recommended based on the effect of incremental stream flow changes on the amount of suitable habitat. Because of its ability to predict habitat availability at different flow rates, this methodology allows for negotiation of flows between parties involved.

Although inherent problems exist with this methodology, it provides the best information available on the effect of a given flow regime on fish habitat. In addition, it makes these predictions for each life history stage for several species of fish. The IFIM is the only methodology available which allows for negotiation of flows. For this reason this technique may prove valuable for those streamflow situations where maintaining ***optimum flows***, rather than minimum flows, is desired.

2) Incremental Approaches for Recreational Use

Incremental approaches can also be used to evaluate recreation using qualitative assessment to determine flow levels that provide the best opportunity for use. Streamflow requirements vary for each recreational activity and for different stream channel characteristics. The two recreation incremental approaches are *Probability-of-Use* and the *Recreational User Survey*.

The Probability-of-Use approach was developed by Hyra (1978) and utilizes an incremental method using a computer simulation model that utilizes similar techniques to those employed by fishery assessment models (e.g., depth/velocity combinations and resulting stream surface area; calculation of the weighted useable surface area). Probability of use curves must be calculated for each specific stream reach and should not be generalized to different reaches where primary recreational uses are

different. In addition, Hyra states that in general no single valid optimal flow exists for recreational use.

The Recreational User Survey approach utilizes user surveys to obtain judgements about the relationship of flows to recreation-related variables. Participants in these studies may experience a single flow rate, a range of flow rates or be exposed to photographic and/or verbal descriptions. In a study conducted by Moore et. al. (1990) actual flows experienced by interviewed participants in Aravaipa Canyon Wilderness were recorded. User responses were then statistically related to measured flows.

The Probability-of-Use and Recreational User Survey approaches develop valuative judgements of the quality of specific recreational activities at different flow rates. The result is a more complete documentation of the relationships between flow rates and recreation.

IV. INSTREAM FLOW HYDROLOGIC ASSESSMENT

In order to support an instream flow request an applicant is required to develop a hydrologic assessment of streamflow specific to the location of the proposed instream flow appropriation. The hydrologic assessment has two primary functions:

1) to demonstrate the availability of requested flows, and

2) to establish an interrelationship between applied for beneficial uses and available streamflow.

An instream flow right is a non-diversionary (in-situ) surface water right. Instream flow rates (monthly and annual total) requested in the application, which are consistent with available streamflow, are the measure of the beneficial use. Instream flow applications cannot request an improbable quantity of streamflow to support the requested beneficial use, therefore, the applicant must establish the quantity of water required to accomplish the purpose of the appropriation. ***Median*** rather than ***mean*** flow rates should be used in hydrologic assessments due to the skewed distribution of daily flows resulting from infrequent high flows. Generally, the median flow rate, or middle value when flow data are ranked in order of magnitude, provides the most probable determination of flow available in a stream.

The goal of the hydrologic assessment is to characterize a flow regime which approximates streamflow conditions associated with the location and duration of beneficial use. A hydrologic assessment is usually easy to complete when gaging station data is available for the stream, however, many streams in Arizona are ungaged. Assessment of these ungaged streams in a manner consistent with streams for which gaging records are available may not be possible. In such streams, virtually any data is valuable even if developed from once monthly or bi-monthly random measurements of streamflow. For both gaged and ungaged streams, any streamflow data gathered can provide valuable insight to the flow regime of the stream and aid in assessment of water available to support an instream flow request. Before beginning the hydrologic assessment of a particular stream to develop an instream flow request, preliminary evaluation of data available for the stream is necessary.

Some of the various methodologies which can be used to construct a hydrologic assessment for both gaged and ungaged streams are described briefly below. These assessments range from determination of median flow rates derived from random ***instantaneous flow measurements*** obtained monthly to analysis of streamflow data obtained from gaged streams using ***flow duration*** and correlative techniques. Appendix A describes techniques used for measurement and determination of streamflow using a current meter. A data collection form for streamflow measurements that may be used by the applicant is included in the back folder.

In order to achieve specific resource objectives, such as requesting flows to meet optimum rather than minimum beneficial use needs, or if it is determined that a more intensive analysis of the data may provide evidence that a greater amount of flow is available for claimed instream flow use(s), the applicant is encouraged to develop an assessment which exceeds the minimum technical requirements.

A. GAGED STREAMS

Assessment of stream flow available for an instream use is usually easy when an active gaging station with a significant long-term period of record is located nearby. A stream gage is considered suitably located if it is capable of providing a direct assessment of water quantity without resorting to indirect methods. Stream gage records for existing or discontinued gaging stations can be obtained from the U.S. Geological Survey. Flow data may also be available from the U.S. Bureau of Land Management, U.S. Forest Service, U.S. Bureau of Reclamation, or university libraries. The flow characteristics of a stream may be analyzed using various statistical techniques such as *flow duration analyses*, if adequate flow data is available. If a long-term record is not available, it may be possible to extend short-term records.

1) Flow Duration Analysis

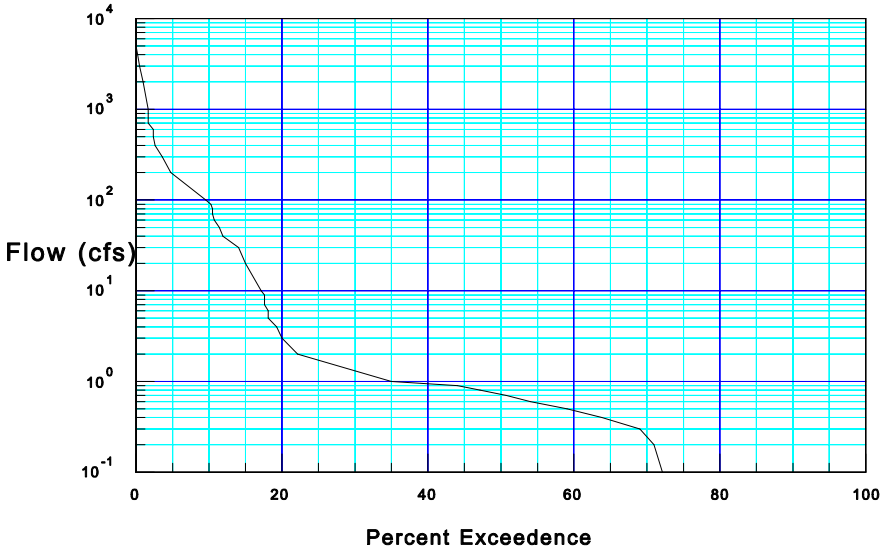
A flow duration curve can be used to assess the flow characteristics of a stream. Figure 1 is an example of a flow duration curve that shows the percent of time specified discharges were equaled or exceeded during the period of record.

To develop an assessment using a flow duration curve, monthly or daily flow volumes are arranged in a rank order tabulation and, for select values of flow exceedence, plotted month-by-month as mid-month values. Records of at least twenty years in length are usually required when an assessment is based on monthly flow volumes. If part of the most recent record is missing, and additional preceding years of data are available, then an extension of the record may be necessary to recover the last twenty years of supporting data for the analysis.

Some gaged streams, however, do not have twenty years of record. Where three to nineteen years of record are available, a flow duration analysis based on monthly flow volumes is not feasible. Confidence limits for such an analysis deteriorate with a smaller sample size. However, other correlative methods are available which may prove useful when preparing an assessment with records of short duration. Flow duration evaluations, based on mean daily flows, can provide a reasonable assessment where as little as three years of record are available. Where records provide less than three years of data, the average monthly flows for each calendar month are generally sufficient for an initial estimate. However, averages derived from short-term records can be biased by high or low flows.

Assessment of gaging station data should include an examination of the record for atypical effects. Operation of dams, diversion of streamflow or discharge of effluent can reduce or increase streamflow which, although not natural in their effect, may become important factors in developing an instream flow request.

Figure 1. Percent Exceedence Curve



The most recent twenty years of record is adequate to develop a water supply based on a flow duration analysis of monthly flow volumes. Periods of record less than twenty years in length may require a more intensive analysis such as examination of mean daily flows to complete a flow duration analysis, or alternative correlative methods.

In addition to flow duration analyses, streamflow hydrographs are also valuable tools in understanding a stream's flow regime. Hydrographs are typically constructed from mean daily flow values obtained at a gaging station. The data is graphically illustrated and can show both seasonal and long-term trends in flow.

2) Extending Short-Term Records

Some streams may have gaging station records of only a few years in length. Where a gaging station has substantially less than twenty years of continuous, current record, it may be more desirable to reconstruct a correlated record of monthly flows for the missing portion of the most recent record than to complete a more intensive analysis based on a shorter period of record. Use of a longer, continuous period of record provides greater data variation thus enabling a flow duration analysis to be completed for monthly flows. Since instream flow analyses may have beneficial use considerations which examine consistency in monthly flows distributed on a seasonal or annual basis, an extended period of record would also improve this assessment process by readily providing a month-by-month flow history.

Extension of streamflow records using linear regression techniques is well documented in the literature. Linear regression of two concurrent records (one of them being a record of interest) is used to estimate missing values in the record of interest by comparison with the base period of record of a similar nearby gage.

To reconstruct an extended period of record for a stream gage, the following criteria should be maintained:

1. Streamflow should be relatively free from intervening effects of extensive regulation, storage, or diversion.

2. A suitable primary station should be available for correlation.

3. The maximum standard error of estimate or spread of about two-thirds of the annual runoff values about the correlation line should be less than about 30%.

4. The coefficient of correlation should be at least 0.80 for data evaluated as fit-by-eye.

This and other similar correlative procedures possess value in extending some streamflow records. However, the amount of data necessary to obtain a satisfactory level of correlation between stream gages may limit the applicability and use of some of these techniques.

B. UNGAGED STREAMS

The vast majority of streams in Arizona have no gaging station records. Applicants must be prepared to measure streamflow where gaging station records are unusable or non-existent. To determine streamflow availability in these streams it is necessary to initiate a program of periodic, on-site ***instantaneous measurement*** of flows or to establish a continual flow measurement device. Selection of an appropriate measurement site and utilization of an applicable technique is important for acquiring streamflow information in an accurate manner. Streamflow measurement sites should be located in areas that provide both channel width and depth stability. Subsequent measurements should be taken at the same site(s), or in close proximity if morphological changes in the streambed render the original site unacceptable.

Quality of data is particularly important when collecting instantaneous flow information. When an instream flow assessment will be based on the minimum data standards, close attention should be given to activities or events that result in abnormally low or high flows. An applicant should limit data collection to streamflows that are "representative and typical" for the flow period of interest (month or season) which includes accounting for upstream diversion activities.

1) Instantaneous Flow Measurement

Instantaneous flow measurement techniques involve dividing stream width into portions or sub-divided segments of the cross-sectional area and measuring the velocity of flow through each segment using a current meter. For individual segments, the discharge is the product of the flow velocity and the area. Summing the corresponding discharge calculations of all segments yields an instantaneous value of

the streamflow for the total cross-sectional area. A step-by-step guide to conducting an instantaneous flow measurement is presented in Appendix A.

2) In-Place Flow Measurement Devices

Another way to accomplish streamflow measurement is to establish an in-place streamflow measurement device such as a stage gage. A recording stage gaging station produces a continuous time-stage graph. Stage is converted to discharge using a stage-discharge relationship developed specifically for the gaging station. These stations should be located in a cross-sectional area of the stream channel (as measured in a vertical plane perpendicular to the direction of streamflow) that is composed of more or less non-erodible streambed and banks. Sufficient data will need to be collected to establish a stage-discharge relationship at the location of the gage or recorder. Periodic review of the channel cross-section and discharge will be necessary to determine if any shift in the channel has significantly altered the stage-discharge relationship. Many Arizona streams experience frequent, significant cross-sectional changes. Where significant changes have occurred, appropriate adjustments must be made in subsequent discharge estimates.

Installation of streamflow measurement devices not only provides greater continuity of collected data, it also allows for a more thorough assessment of available water resources. Gaging stations, particularly those equipped with continual recording devices, can be expensive. On-site stream gage installation, while preferred, will usually not be required. However, when a program of periodic instantaneous flow measurements is undertaken, the applicant must be prepared to carry it out on schedule in order to avoid critical data gaps. Some gaps in data can be avoided by installing staff or crest gages when frequent high flows make streams inaccessible.

C. HYDRAULIC SIMULATION

The *hydraulic simulation* methodology has value in that it can be used to assess streamflow availability for a particular instream use or to develop a stage-discharge relationship. It can be applied to data collection from gaged or ungaged streams to assess instream flow use needs and/or streamflow availability.

After several site-specific flow measurements have been collected, a specified ***minimum flow rate*** is determined based on a simulation of the measured range of flows. This is done to determine flows required to maintain a certain desired instream flow use or to develop a stage-discharge relationship to estimate streamflow at a particular fixed location. Because hydraulic variables used in the determination of flow change with variations in depth and velocity, an appropriately calibrated simulation is required. To accomplish this, site-specific flow measurements must be collected from the full range of flows likely to occur. Calibration of the simulation is realized when hydraulic variables, taken as a function of depth, yield flows equal to the measured flows determined during field surveys.

When high flows occur and stream channel morphology is altered, it may be necessary to use flow modeling techniques to analyze flow conditions and to verify velocity and depth at the desired level of flow. General calibration standards applicable to hydraulic simulation dictate that the amount of error

between measured and simulated flows be less than the error in the measured flow, regardless of the simulation technique used.

This type of technique has also been used to synthesize flow data for ungaged streams using the gage data obtained from streamgages located upstream or downstream of the proposed stream segment or located in a stream in an adjacent watershed. However, while this technique can be used to synthesize data it does not substitute for on-site streamflow measurements.

V. SUMMARY

The streamflow data and report submitted to the Department must, at a minimum, include the criteria described in Step 4 (pgs. 3-4) of this guide. Additional data and information may be required depending on the complexity of the stream system, associated uses, and legal issues. To support an instream flow application an applicant must:

1) Quantify the amount of streamflow available during the periods of claimed beneficial use, and

2) Quantify the relationship between claimed flows and beneficial uses.

Methods to evaluate instream flow and beneficial use flow requirements are divided into two basic categories; standard setting and incremental. These methods, when used in conjunction with adequate hydrologic data, can be used to support an instream flow claim. Standard setting methods are categorized as either "Non-field" (including the Narrative Justification Method) or "Habitat Retention". These methods are generally applicable to streams that are currently not diverted or provide limited consumptive use opportunities. The Narrative Justification Method provides a qualitative description between streamflow and claimed beneficial uses. Habitat Retention methods, such as single and multiple transect, are used to determine the "limiting" factors associated with the claimed stream segment. These methods can be species and/or activity specific, but are limited to determining minimum streamflow requirements.

Another technique, the Interdisciplinary Approach combines elements of other evaluation methods. The intensity of the evaluation is dependent on resource needs and legal issues associated with the particular stream or stream segment.

Incremental methods more completely assess the relationship between streamflow and specified beneficial uses. These techniques, therefore, are the most defensible, yet the most expensive and labor intensive. The IFIM can be used to assess streamflow for several fish species and some recreation activities. Incremental techniques can be applicable to situations where documentation of the affect of multiple flow rates on species habitat or activity quality are necessary. These situations may include heavily diverted streams, streams with regulated flows or flows that are largely supported by effluent discharge.

Fewer incremental techniques have been developed for recreation uses. Valuative judgements developed from techniques, such as the Probability-of-Use or the Recreational Survey Approach, should be based on multiple flow-rate observations by local experts.

Quantification of streamflow depends on streamflow data availability. When twenty or more years of current, continual data are available, streamflow may be quantified utilizing a monthly flow duration analysis. Flow duration evaluations, based on mean daily flows, can provide a reasonable assessment where as little as three years of record are available. Where records provide less than three years of data, the average monthly flows for each calendar month are generally sufficient for an initial estimate. For gaging stations with a short period of record, it may be preferable to reconstruct a correlated

record of monthly flows for the missing portion of the record than to complete a more intensive analysis based on a shorter period of record.

Current, continual flow information does not exist for most Arizona streams. If flow data for a particular stream or stream segment are not available, it is necessary to install a continual flow recorder or to initiate collection of monthly or bi-monthly flow measurements.

A minimum of one year of streamflow data collected on-site on a monthly or seasonal basis is necessary to obtain an instream flow permit. Drought, flood events and diversion activities can substantially affect streamflow. When limited data, particularly instantaneous, are all that is available to quantify streamflow, it is critical that data collection occur when streamflow is "typical" for the month or season in question. To maintain randomness in the data collection more than one monthly measurement or three seasonal measurements should be obtained.

To determine which data collection procedures and data evaluation techniques are most applicable to a particular stream or stream segment, an instream flow applicant should meet with ADWR personnel prior to initiating the streamflow evaluation process.

VI. GLOSSARY

Affidavit of appropriator - A sworn statement affirming the Proof of Appropriation contents.

Affidavit of public notice - A sworn statement affirming the location and date of posting of copies of the Notice of Application for a Permit to Appropriate Public Water.

Application - An Application for Permit to Appropriate Public Water is made to ADWR by anyone intending to acquire the right to beneficially use water.

Appropriation - An instream flow appropriation requires that a specific amount of water flow through a claimed stream reach(es) to protect fish, wildlife, or recreation.

Baseflow - The part of streamflow derived from groundwater discharging to the stream.

Beneficial use - Beneficial uses recognized by the State of Arizona that can be accomplished without diversion are wildlife, including fish, and recreation.

Certificate of Water Right - Issued after an appropriation has been perfected by demonstrating that the streamflow is being put to beneficial use and terms of the permit are being met. Designates the owner of the right, priority date, and extent and purpose of the right.

Consumptive Use - Water which by use (or diversion) is lost to the stream system and other users therein.

Critical reach(es) - Areas of a stream where a species or an activity are particularly sensitive to changes in flow levels. These areas contain micro-habitat that is essential to the survival of a species. They are generally spawning areas or riffles that restrict passage.

Discharge - Represents the volume of water observed flowing in a stream past a specific point over a given period of time.

Flow duration analysis - A representation of the number of times flows are equaled or exceeded during a given period of record.

Habitat suitability curve (criteria) - A component of an IFIM model. The relative value of a specified range of micro-habitat variables (depth, velocity, substrate and cover) for the successful completion of life stage requirements of a selected evaluation species.

Hydraulic properties - Represented by factors such as velocity, depth, width, and substrate of stream.

Incremental methods - Use computer models to relate site-specific hydraulic properties to water requirements of target species and generate data on amount of habitat available for various increments of flow.

Instantaneous flow measurement - The measurement of stream discharge at a specific time using nonrecording methods. Examples of methods include use of a current meter, portable flume, and measurement of stage by reading staff gage height.

Instream flow - Flow that remains in-situ, or "in-stream", and will not be physically diverted or consumptively used.

Mean flow rate - The sum of all streamflow measurements in a sample divided by the number of measurements in the sample.

Median flow rate - The middle value in a distribution of streamflow measurements above and below which lie an equal number of values.

Minimum flow rate - A flow rate that provides enough water to meet the basic needs of a particular species or activity at or near subsistence level. Provides enough water for species survival, but not necessarily enough for good health, optimum growth, vigor or fecundity.

Monitoring Point - The location at which streamflow measurements are taken to support claimed instream flows. Can be the gaging station location or the location of instantaneous flow measurements.

National Wild and Scenic Rivers System - Established by the Wild and Scenic Rivers Act of 1968 to protect rivers and their immediate environments that have outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural and other similar values and are preserved in free-flowing conditions**.**

Optimum flow rate - Adequate flow is available to meet all the needs of a species or activity. Productivity or use should be high as a result. Health, growth and fecundity will approach the maximum for a given species.

Permit - A Permit to Appropriate Public Water grants authority to begin the appropriation of public surface water. Designates the quantity of water to be appropriated, the source of water, and the appurtenant stream reach.

Pool - Portion of a stream that is deep and slow moving relative to the main current.

Priority Date - The filing date of the original application. It is a means of ranking the water right in relation to all other water rights within a specific watershed.
Proof of appropriation - A series of statements of the appropriator, under oath, supporting that the appropriation has been perfected.

Public notice - The process of giving notice of the application to persons who could reasonably be affected by the appropriation.

Riffle - Shallow rapids where water flows swiftly over partly submerged obstructions.

Riparian area - An aquatic or terrestrial ecosystem that is associated with bodies of water such as streams, lakes, or wetlands or is dependent upon the existence of perennial or intermittent surface or subsurface water drainage.

Riparian National Conservation Area - An area of outstanding riparian, and other resource values, designated by Congress for the protection and enhancement of these values.

Run - A stretch of fast-flowing water with nonturbulent surface flow.

Standard setting methods - Establish flow rates required for a certain (standard) level of habitat quality based on the judgement of experienced professionals.

Stream reach(es) - Any specified length(s) of a stream. For instream flow, the section(s) of stream owned by the applicant and for which an instream flow right is sought.

Unique Waters - In Arizona, streams are designated as unique waters on the basis of one of the following criteria; 1) exceptional recreational or ecological significance, 2) is essential to or provides critical habitat to the maintenance of associated threatened or endangered species. The State of Arizona sets water quality standards for Unique Waters.

Weighted useable area - An index that represents the amount of suitable habitat for a given species and life stage.

Wetted perimeter - The total length of a cross-section at the interface between a channel bed and the stream which occupies it.

Wild and Scenic Study River - Rivers identified in Section 5 of the Wild and Scenic Rivers Act for study as potential additions to the National Wild and Scenic Rivers System.

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Rantz, S.E. and others. 1982. Measurement and computation of streamflow - Volume 1: Measurement of stage and discharge, Volume 2: Computation of discharge. U.S. Geological Survey Water-Supply Paper No. 2175. 631 pp.

Stalnaker, C. and others, 1994. The Instream Flow Incremental Methodology: A Primer for IFIM. National Biological Survey. Fort Collins, Colorado. 99 pp.

U. S. Bureau of Land Management. 1994. Draft - Arizona Statewide Wild and Scenic Rivers legislative environmental impact statement: U.S. Department of the Interior, Bureau of Land Management, Arizona State Office, April 1994 (BLM/AZ/PL-94/004+4333). 143 pp.

APPENDIX A

CURRENT METER MEASUREMENT PROCEDURES

Sources: Buchanan, T.J, and Somers, W.P., 1969, Discharge measurements at gaging stations. U.S. Geological Survey Techniques Water-Resources Investigations, Book 3, Chap. A8, 65 p.

Rantz, S. E. and others, 1982, Measurement and computation of streamflow: Volume 1. Measurement of stage and discharge. U.S. Geological Survey Water-Supply Paper 2175, 284 p.

Step 1

Select a section of the stream containing the following:

1. A straight reach with flow parallel to the stream banks.
2. Flow that is relatively uniform (laminar) and free of eddies, slack water and excessive turbulence.
3. A stable streambed free of large rocks, weeds, and protruding obstructions which would create turbulence.
4. A flat streambed profile to eliminate vertical components of velocity.
5. From the selected reach, select the best possible cross-section.

Step 2

At the selected cross-section, do the following:

1. Determine the width of the stream by stringing a measuring tape at right angles to the direction of flow.
2. Determine the spacing of vertical subsections, generally using 25-30. With a smooth cross-section and good velocity distribution, fewer subsections may be used.
3. Space the subsections so that none has more than 10% of the total discharge. Equal width subsections are not recommended unless the discharge is well distributed.
4. Make the width of subsections less as depths and velocities increase.

Step 3

Record the following information for **each** measurement:

1. Name and agency of collector
2. Date of measurement
3. Type of meter
4. Legal location of measurement
5. Description of stream channel at measuring point such as:
    a. natural or artificial controls
    b. streambank conditions
    c. channel bottom roughness
    d. streamflow characteristics
6. Any other pertinent information regarding the accuracy of the measurement

Step 4

Perform the discharge measurement.

1. Identify the stream bank by either left edge of water (LEW) or right edge of water (REW), when facing downstream.

2. **Record the start time .**

3. **Record the distance from the initial point to the edge of water.**

4. Measure and **record the depth of water.**

5. After the depth is known, determine the method of velocity measurement (0.6, 0.2- 0.8, etc).

6. After the meter is placed at the proper depth, allow it to become adjusted before starting the measurement.

7. Count the number of revolutions for a period of 40-70 seconds (pygmy) or read the velocity display (Marsh-McBirney).

8. For the pygmy meters, the stopwatch should be started with the first click counting "zero", **not** "one". After 40 -70 seconds, stop the stopwatch on a **convenient number given in the rating table.** Read the time to the nearest second.

9. **Record the velocity** (Marsh-McBirney) **or the number of revolutions and the time interval** (pygmy).

10. Repeat nos. 3-10 for each vertical subsection until the entire cross-section is traversed.

11. **Record the end time.**

Notes:

For wading measurements:

1. Stand at least 18 inches downstream from the wading rod.

2. Hold the wading rod in a vertical position 1 to 3 inches downstream from the tag line.

3. Keep the meter parallel to the direction of flow.

The 0.6 method

1. The velocity measurement is taken at 0.6 of the depth below the surface (0.4 above the streambed) in each vertical subsection.

2. Recommended for depths between 0.3 and 1.5 feet, when using the pygmy or Marsh-McBirney meters.

3. Recommended for all meters when the stage is changing rapidly and a measurement must be made quickly.

The 0.2- 0.8 method

1. The velocity measurement is taken using the 0.2 & 0.8 method if depths are greater than 1.5 feet, when using the Marsh-McBirney. This method is **not** recommended for the pygmy meter.

2. When using the top-setting wading rod graduated for 0.6, the 0.2 depth setting is obtained by **multiplying** the depth of water by 2. The 0.8 depth setting is obtained by **dividing** the depth by 2.

3. The average of the two observations is taken as the mean velocity in that vertical subsection.

Current meters are **not** recommended for flows with less than 0.2 fps per vertical subsections. Use the volumetric method, Parshall flume or weir plate under these conditions.

APPENDIX B

GUIDE FOR PREPARING A NARRATIVE JUSTIFICATION FOR AN ISF WATER RIGHT

In the narrative justification method the applicant must describe the **beneficial use** for which the instream flow right is sought. Streamflow use must, at a minimum, describe the relationship between requested streamflow and the benefits received by wildlife, including fish, and/or recreation activities. An effort should be made to describe possible **negative effects** if for some reason the flow would decrease below the requested levels. The following is a list of information needed in a narrative justification for a competent and speedy review.

1. Statement of the main objective of the proposed instream flow request.

2. Description of beneficial uses (i.e. wildlife, including fish, or recreation).

3. Description of fish and wildlife resources including inventory and population.

4. Description of any unique habitat.

5. Description of any threatened or endangered species.

6. Description of the relationship between the beneficial uses and the requested instream flows.

7. Description of accessibility to site and type of recreation, if applicable.

8. Description of physical setting.

9. Description of the bed and/or channel morphology of the stream.

10. Description of type and source of streamflow including any groundwater-surface water interactions; include number of rivermiles of claimed reach.

11. Description of data collection methods including, at a minimum, type of meter or gage and legal Description of site.

12. Minimum of one year of streamflow measurements, at least one per month or three per flow season.

13. Submittal of raw field data with discharge calculated; applicants are urged to use the form entitled
Instream Flow Measurement Notes in the back folder.

14. An assessment of the quantity of water historically available at the location of the proposed instream appropriation. Provide streamflow hydrographs and flow duration curves, if possible.

15. Streamflow analysis and resulting monthly or seasonal streamflow requests as well as the total annual amount requested for appropriation.

16. Description of negative effects on beneficial use if flow falls below requested levels.

17. Description of the potential impact of the instream flow appropriation on existing surface water rights and on the interests and welfare of the public of the State of Arizona.

18. Map of area which includes the following:

- map scale, Township, Range, Section and north arrow
- delineation of reach covered by requested appropriation (indicate if perennial or intermittent)
- watershed boundary
- location and identification of nearest gage(s); name, #, operated by
- location of instantaneous measurement
- land ownership boundaries

19. Pictures of the reach, including at least one of each measuring point would be helpful.

APPLICATION GUIDELINES
Permit to Appropriate Public Water
of the State of Arizona - Instream Flow Maintenance

In accordance with A.R.S. §§ 41-1008 and 1079, the Department of Water Resources, Surface Water Rights Unit, provides the following information regarding the application review process to assist applicants for a Permit to Appropriate Public Water of the State of Arizona - Instream Flow Maintenance.

Steps for Processing Your Application and Obtaining Approval

Before filing your application, the Department encourages you to contact one of the Department personnel indicated at the end of these guidelines to discuss the application process and review criteria. If you wish, a meeting may be scheduled to facilitate this process. To assist you in understanding the substantive requirements for this application, a copy of A.R.S. §§ 45-152, 45-153 and 45-162 is provided for your information.

It is imperative that you complete the application form in its entirety. An incomplete or incorrect application may result in a delay in processing your application. Please send the application to the address indicated on the form, along with any required fees and supporting documentation. The Department suggests that you retain a copy of all documents which are submitted for review. The first step in perfecting a water right is obtaining a Permit to Appropriate - Instream Flow Maintenance. The Licensing Time Frame associated with this process is 581 days. The application fee for this permit is $50.00 if the quantity of use is less than 50 acre-feet, $75.00 if the quantity of use is 50 acre-feet or more. If the application is approved and a permit is issued, the permit fee is $25.00 if the quantity of use is less than 50 acre-feet, $50.00 if the quantity of use if 50 acre-feet or more. The second step in perfecting a water right is obtaining a Certificate of Water Right. The Licensing Time Frame associated with this process is 207 days. The fee for a Certificate of Water Right is $50.00. The fees are authorized by Arizona Adminstrative Code Rule R12-15-151.

I. Time Frames for Review of Your Application.

Within 581 days after receipt of your application, the Department will determine whether your application should be granted or denied, unless this time is extended as described below. In processing your application, the Department will first determine whether the application is administratively complete (administrative completeness review), and then whether the application meets the substantive criteria established by statute or rule (substantive review). Each of these reviews will be completed within the times stated below. The time for the administrative completeness review plus the time for the substantive review is referred to as the overall time frame.

1) Administrative Completeness Review Time Frame

Within 51 days after receipt of your application, the Department will determine whether your application is complete, and will issue a written notice of administrative completeness or deficiencies. After your application is complete, the Department will proceed with substantive review.

information is received. If you do not supply the missing information within 60 days, the Department may deem your application withdrawn and close the file.

2) Substantive Review Time Frame

Within 187 days after the application is complete, the Department will review your application to determine whether it meets the substantive criteria required by statute or rule. By mutual written agreement between you and the Department, the time for substantive review may be extended by up to 51 days.

During the substantive review, the Department may make one written request for additional information. You may also agree in writing to allow the Department to submit supplemental requests for additional information. If additional information is requested by the Department, both the substantive review and overall time frames will be suspended. When the additional information is received, the substantive review and overall time frames will resume.

At the end of the Department's substantive review, the Department will send you a written notice either granting or denying your application. If your application is denied, the notice will include the justification for the denial and an explanation of your right to appeal the denial.

Agency Contact

Please direct any questions, comments or requests for further assistance to Gerry Wildeman or Elizabeth Logan in the Surface Water Rights Unit at (602) 417-2442.

Arizona Revised Statutes §§ 45-152, 45-153 and 45-162

45-152 . Application for permit to appropriate water

A. Any person, including the United States, the state or a municipality, intending to acquire the right to the beneficial use of water, shall make an application to the director of water resources for a permit to make an appropriation of the water. The application shall state:
1. The name and address of the applicant.
2. The water supply from which the appropriation is applied for.
3. The nature and amount of the proposed use.
4. The location, point of diversion and description of the proposed works by which the water is to be put to beneficial use.
5. The time within which it is proposed to begin construction of such works and the time required for completion of the construction and the application of the water to the proposed use.
B. The application also shall set forth:
1. If for agricultural purposes, the legal subdivisions of the land and the acreage to be irrigated.
2. If for power purposes, the nature of the works by which power is to be developed, the pressure head and amount of water to be utilized, the points of diversion and release of the water and the uses to which the power is to be applied.
3. If for the construction of a reservoir, the dimensions and description of the dam, the capacity of the reservoir for each foot in depth, the description of the land to be submerged and the uses to be made of the impounded waters.
4. If for municipal uses, the population to be served, and an estimate of the future population requirements.
5. If for mining purposes, the location and character of the mines to be served and the methods of supplying and utilizing the waters.
6. If for recreation or wildlife, including fish, the location and the character of the area to be used and the specific purposes for which such area shall be used.
C. The application shall be accompanied by maps, drawings and data prescribed by the director.

45-153 . Criteria for approval or rejection of applications; restrictions on approval

A. The director shall approve applications made in proper form for the appropriation of water for a beneficial use, but when the application or the proposed use conflicts with vested rights, is a menace to public safety, or is against the interests and welfare of the public, the application shall be rejected. An administrative hearing may be held before the director's decision on the application if the director deems a hearing necessary.
B. An application may be approved for less water than applied for if substantial reasons exist but shall not be approved for more water than may be put to a beneficial use. Applications for municipal uses may be approved to the exclusion of all subsequent appropriations if the estimated needs of the municipality so demand after consideration by and upon order of the director.
C. If the director approves an application for the appropriation of water for use on land owned by the state of Arizona, a permit or certificate shall be issued as prescribed by section 37-321.01. If the director approves an application for the appropriation of water for use on land

ARIZONA DEPARTMENT OF WATER RESOURCES
SURFACE WATER RIGHTS
MAIL TO: P.O. BOX 458
PHOENIX, ARIZONA 85001-0458
500 North Third Street
Phoenix, Arizona 85004-3921
Telephone (602) 417-2442
Fax (602) 417-2424

(For office use only)

Registry No:_____

Date Filed:_____

APPLICATION FOR PERMIT TO APPROPRIATE PUBLIC WATER OF THE STATE OF ARIZONA INSTREAM FLOW MAINTENANCE

1. Applicant_____ Telephone_____

   Address_____ City _____State_____ Zip_____

2. Type of water source and name _____

   a tributary to _____ within the _____ watershed.
   (For office use only)

3. Describe the proposed use of the instream flow appropriation for wildlife (including fish) and/or recreation:

   _____

   _____

   _____

4. Amount of proposed instream flow appropriation (see item #9 for required attachments):

   a. Monthly instream flow requirement (cubic feet/second):

JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

   b. Total annual volume_____ acre feet/year

5. Location of proposed instream flow appropriation: County_____

   Describe entire reach to be covered by this application, utilizing legal land parameters. Also attach a U.S.G.S. topographic quadrangle map(s) clearly showing the location of the entire reach or segment of the proposed instream flow appropriation.

   _____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

   _____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

   _____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

   _____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

   _____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

   _____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

ARIZONA DEPARTMENT OF WATER RESOURCES
SURFACE WATER RIGHTS
MAIL TO: P.O. BOX 458
PHOENIX, ARIZONA 85001-0458
500 North Third Street
Phoenix, Arizona 85004-3903
Telephone (602) 417-2442
Fax (602) 417-2424

Permit No: _____

(For office use only)

Date Filed:_____

PROOF OF APPROPRIATION OF WATER - INSTREAM FLOW MAINTENANCE

1. Applicant_____ Telephone _____

   Address_____ City _____State_____ Zip_____

2. Type of water source and name _____

   a tributary to _____ within the _____ watershed.
   (For office use only)

3. a. List the beneficial uses for which the instream flow maintenance is utilized: _____

   _____

   b. Monthly instream flow as supported by final data submittal to Hydrology Division(cubic feet per second)

JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

   c. Total annual volume_____acre-feet/year

   d. Name of measuring point(s) _____

   e. Location of measuring point(s)

   _____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

   _____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

4. Location of instream flow appropriation: County_____

Describe entire reach to be covered by certificate, utilizing legal land parameters. Attach additional sheet if necessary.

_____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

_____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

4. Location (continued)

_____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

_____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

_____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

_____¼ _____¼, Section _____, Township _____N/S, Range _____E/W

5. Owner of the land described above:_____

6. **REQUIRED ATTACHMENT:**

Copy of recorded deed showing land ownership. If owned by other than applicant, provide copies of all pertinent leases, grazing permits, allotments, or letter from landowner authorizing the proposed appropriation.

Arizona Department of Water Resources
500 North Third Street
Phoenix, Arizona 85007

NOTICE OF APPLICATION TO APPROPRIATE PUBLIC WATER INSTREAM FLOW MAINTENANCE

In the matter of application assigned number KEYBOARD(). KEYBOARD() has filed an Application for Permit to Appropriate Public Water, dated KEYBOARD().

The application states:

1. Source of Water: KEYBOARD()
2. Proposed use and amount: KEYBOARD()
3. Place(s) of use: KEYBOARD()

A map depicting the proposed place of use is attached to this notice.

KEYBOARD(other conditions)

Objections to the issuance of the Permit to Appropriate Public Water may be filed by any person who alleges that the proposed appropriation conflicts with vested water rights, is a menace to public safety, or is against the interests and welfare of the public. Objections must be submitted either in writing or on a form provided by the Department to the Arizona Department of Water Resources, Surface Water Rights, 500 N. 3rd St., Phoenix, AZ 85004, within sixty (60) days of the date of issuance of the Notice. A copy of the stated objections must also be forwarded to the applicant.

The Notice is issued this day of KEYBOARD(), 19KEYBOARD().

ARIZONA DEPARTMENT OF WATER RESOURCES

One copy sent to the applicant and one to:

KEYBOARD()

AFFIDAVIT OF APPROPRIATOR

STATE OF ARIZONA }
}ss.
County of_____}

I, _____, being first duly sworn, state that I have read the attached proof of appropriation of water; that I know the contents thereof, and that the facts therein stated are true.

IN WITNESS WHEREOF, I set my hand this_____ day of_____, 19_____.

_____
Signature of Appropriator

_____
Signature of Appropriator

Subscribed and sworn to me this _____ day of _____, 19_____.

(Notary Seal) _____
Notary Public

My commission expires _____

AFFIDAVIT OF WITNESS

(Two witnesses required)

STATE OF ARIZONA }
}ss.
County of_____}

We, _____ and _____

of _____, being first duly sworn, state that we are acquainted with the facts and conditions set forth in the attached statement relative to proof of appropriation of water under Permit No. _____, that we have inspected each tract described therein, and from such personal inspection have knowledge that all necessary ditches, dams and other diversions and distributing works have been constructed, and water used as stated therein; that we have carefully read the proof of appropriation, and that the statements contained therein are true to the best of our knowledge and belief.

_____
Signature of Witness

_____
Signature of Witness

Subscribed and sworn to me this _____ day of _____, 19_____.

(Notary Seal) _____
Notary Public

My commission expires _____

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
HYDROLOGY DIVISION

INSTREAM FLOW MEASUREMENT NOTES

ISF No. _____ Date _____

Applicant _____ Weather _____

Stream Name _____ Air Temp _____

Party _____

Topo Quad _____

Cadastral____1/4 of____1/4 of____1/4 of Sec_____T _____ R _____ or Local ID_____

Latitude _____ Longitude_____

Lat/Long Method: Map, GPS-corrected, GPS-uncorrected

Locality_____

_____

Width_____ Area_____ Total Discharge (from back)_____

Method of measurement: 0.2-0.8, 0.6 Type of meter_____

Standard error _____ Meter No._____

Date rated _____ Spin: before _____ after _____

Measurement rated excellent (2%), good (5%), fair (8%), poor (>8%); based on field observations

Cross-section_____

_____

Remarks_____

_____

_____

Water Quality: Temp _____ D.O._____ Comp. by _____

pH _____ Spec. Cond._____ Checked by _____

Rev. 6/21/96 SR

ISF No._____ Date _____

Measure Point	Distance from Initial Point	Interval Width	Depth of Water	Obs. Depth	# of Revol.	Time (secs)	Velocity		Area of Interval	Discharge (cfs)
							@ Point	Mean		
LEW										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
									Total Discharge	